

## COMPARISON OF OCULAR OUTCOMES IN TWO 14-DAY BED REST STUDIES

RL Cromwell<sup>1</sup>, SB Zanello<sup>1</sup>, PO Yarbough<sup>1</sup>, G Taibbi<sup>2</sup>, G Vizzeri<sup>2</sup>

<sup>1</sup>Universities Space Research Association, 3600 Bay Area Blvd., Houston, Texas, 77058

<sup>2</sup>The University of Texas Medical Branch, 301 University Blvd., Galveston, Texas, 77555

Reports of astronauts' visual changes raised concern about ocular health during long-duration spaceflight. Some of these findings included hyperopic shifts, choroidal folds, optic disc edema, retinal nerve fiber layer (RNFL) thickening, and cotton wool spots. While the etiology remains unknown, hypotheses speculate that hypertension in the brain caused by cephalad fluid shifts during spaceflight is a possible mechanism for these ocular changes. Head-down tilt (HDT) bed rest is a spaceflight analog that induces cephalad fluid shifts. In addition, previous studies of the HDT position demonstrated body fluid shifts associated with changes in intraocular pressure (IOP). For these reasons, vision monitoring of HDT bed rest subjects was implemented for NASA bed rest studies.

Subjects selected for these studies were healthy adults (14 males and 5 females). Average age was  $37.5 \pm 9.1$  years, weight was  $77.4 \pm 11.3$  Kg, and height was  $173.4 \pm 7.2$  14 cm. Controlled conditions followed for all NASA bed rest studies were implemented. These conditions included factors such as eating a standardized diet, maintaining a strict sleep wake cycle, and remaining in bed for 24 hours each day. In one study, subjects maintained a horizontal ( $0^\circ$ ) position while in bed and were exercised six days per week with an integrated resistance and aerobic training (iRAT) program. In the other study, subjects were placed at  $6^\circ$  HDT while in bed and did not engage in exercise.

All subjects underwent pre- and post bed rest vision testing. While the battery of vision tests for each study was not identical, measures common to both studies will be presented. These measures included IOP and measures that provided an indication of optic disc swelling as derived from optical coherence tomography (OCT) testing: average retinal nerve fiber layer (RNFL) thickness (mm), disc area ( $\text{mm}^2$ ), rim area ( $\text{mm}^2$ ), and average cup to disc (C/D) ratio.

For all measures, there was no significant difference between subject groups for pre-bed rest testing. Post bed rest values also remained similar between groups. Comparison of pre- to post bed rest testing within each group did not demonstrate any statistical differences.

These preliminary results from 14-day bed rest studies suggest that the combination of exercise and horizontal bed rest as compared to  $6^\circ$  HDT bed rest did not produce differences in the ocular response with regard to IOP and optic disc parameters. The ocular measures reported here only included pre- and post bed rest time points. Further investigation is needed to examine both the acute response and long term adaptation of structural and functional ocular parameters in the bed rest platform and determine its usefulness for studying spaceflight phenomena. From a clinical perspective, the ability to study ocular responses in the controlled environment of the bed rest platform can provide valuable information for the care of patients restricted to bed rest.